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MICROBIOLOGICAL BURDEN ON THE SURFACES OF THE AIMP SPACECRAFT

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SUMMARY

Decontamination of the AIMP spacecraft has proceeded through five stages of its assembly. Data obtained so far indicate that the average microbial contamination on various surfaces of the spacecraft during the five phases of assembly is 9.6×10^3 viable particles per square foot of surface before decontamination, and 2.3×10^2 viable particles per square foot of surface after decontamination.

Extrapolation of the data obtained from the first five phases of assembly indicates that the decontamination procedure will reduce the microbiological contamination of a completely assembled spacecraft by approximately 2 logs.

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INTRODUCTION

Decontamination of the Anchored Interplanetary Monitoring Platform (AIMP) has progressed through five assembly phases. This is the second of a series of reports* on the microbial contamination of various surfaces of the AIMP as the spacecraft is being assembled. Final assembly of the spacecraft will not be completed for several weeks. This work was performed during the period from December 13, 1965 to February 1966 (Table 1).

MATERIALS AND METHODS

Surfaces Sampled for Microbial Contamination

Table 1 lists parts of the spacecraft sampled during each assembly phase.

Sampling Procedure

The sampling technique was the same as that reported in Reference 1. Whenever possible, the entire surface of a piece part was sampled. If the part was too large to be sampled with a single swab, several swab samples were taken, using sterile paper templates to obtain quantitative data.

Whenever possible a piece part was sterilized by autoclaving, or by dry heat. Table 1 indicates parts sterilized. These parts were bolted into place under clean-room conditions and were handled aseptically. The large sections of the Goddard and Ames booms were prebaked by dry heat at 350°F for 60 minutes. The booms were then cooled to room temperature, sprayed with lacquer for evaporation and baked again at 325°F for 60 minutes. All openings were sealed with aluminum foil to maintain the integrity of the interior. After insertion of the cables into the boom and assembly of other parts, all openings were covered with sterile rubber tubing tightly taped in place.

Decontamination

(See Report 1.)

*See reference, page 6.

Table 1

Parts of AIMP Sampled for Microbial Contamination

Assembly Phase	Spacecraft Parts	Occluded Surface Area (sq. in.)	Area Sampled (sq. in.)
1 (11-30-65)	C-frame base & platform mating surface	56	56
	Lower cone support ring & platform mating surface	272	80
2 (12-13-65)	C-frame	450	83
	*Antenna cup brackets (8)	4	4
	*Stiffeners (26)	39	39
	*Despin-disconnect brackets (6)	4	4
	Yo-yo disconnect brackets (2)	4	4
3 (12-23-65)	Struts (8) & center tube mating surface	27	27
	Platform lower surface	400	88
	Paddle-support brackets (4) & platform mating surface	150	150
	Struts (4) & paddle-support brackets mating surface	32	32
	Boom-support bracket & platform mating surface	18	18
	Boom brackets (2) & boom-support bracket mating surface	18	18
	Platform-support brackets & platform mating surface	16	16
	Struts & platform-support mating surfaces	8	8
	Struts (8) & boom-support bracket mating surfaces	8	8

*Sterilized

Table 1 (Continued

Assembly Phase	Spacecraft Parts	Occluded Surface Area (sq. in.)	Area Sampled (sq. in.)
4 (1-3-66)	Paddle hinge (4) & paddle-bracket mating surface	50	50
	Paddle-arm resistors (8) & mating surface	16	16
	Umbilical connector bracket (1) & platform mating surface	8	8
	Solar-cell damage experiment connector bracket (1) & mating surface	3	3
	Paddle spring brackets (4) & mating surfaces	4	4
	Fourth-stage flyaway boxes (4) & mating surfaces	16.8	16.8
	Back of fourth-stage spring housing & mating surface	2	2
	Back of fourth-stage micro-switch assembly & mating surface	5.1	5.1
	Filter cons (4) & platform mating surfaces	24	24
	Diode dump resistor box (1) & platform mating surface	5	5
	Center tube interior	340	20
5 (2-7-66)	Interior of Goddard boom (large sect)	167	167
	Interior of Ames boom (large sect)	167	167

Table 1 (Continued)

Assembly Phase	Spacecraft Parts	Occluded Surface Area (sq. in.)	Area Sampled (sq. in.)
5 (2-7-66)	Interior of Goddard boom (small sect)	75	3
	Interior of Ames boom (small sect)	75	3
	Goddard boom cable (outer surface of bundle)	113	20
	Ames boom cable (outer surface of bundle)	113	20
	Fluxgate boom connector plate (Goddard)	3	3
	Fluxgate boom connector plate (Ames)	3	3
	Fluxgate boom gold insert (Goddard)	3	3
	Fluxgate boom gold insert (Ames)	3	3
	Fluxgate boom housing interior (Goddard)	21	21
	Fluxgate boom housing interior (Ames)	3	3

Media

(See Report 1.)

Incubation

(See Report 1.)

RESULTS

Table 2 shows the microbiological contamination detected on occluded surfaces during each phase of AIMP assembly. The figures shown are averages of counts obtained from the various surfaces sampled.

The decontamination procedure appeared effective, as evidenced by the reduction in numbers after decontamination. An average of the counts obtained during the first five phases of the assembly indicates a reduction of about 2 logs per square foot of surface after decontamination.

DISCUSSION

It was previously estimated (Reference 1) that the contamination on the completely assembled AIMP spacecraft (total area of 500 ft^2) would be approximately 1×10^7 organisms before decontamination and 2.8×10^5 organisms after decontamination. This estimation is holding up quite well based on data obtained from the first five phases of assembly of the spacecraft. Table 2 shows that an extrapolation of the data obtained thus far for a spacecraft that is more than half assembled, indicates that contamination of the completely assembled spacecraft will be in the order of 4.8×10^6 organisms before decontamination, and 1.2×10^5 organisms after decontamination.

The difference between the level of contamination before and after decontamination may not be as great as we proceed with the assembly as it was during the early stages of the assembly. This probably reflects the decontamination effort and the care taken to keep the spacecraft as clean as possible. After the second assembly phase, the spacecraft was stored in a portable laminar downflow hood and removed only for some necessary test such as spinning or balancing.

Table 2

Microbial Contamination on Surfaces of the AIMP

Assembly Phase	Date	Average Organisms per Square Foot	
		Before Decontamination	After Decontamination
1	11-30-66	21,174	563
2	12-13-66	22,388	230
3	12-23-66	1,000	75
4	1 -3 -66	2,125	90
5	2 -7 -66	1,299	219
Average per sq. ft.		9,597	235
Average per per spacecraft (500 sq. ft.)		4,798,500	117,500

REFERENCES

Powers, E. M., Microbiological Burden on the Surfaces of the AIMP Spacecraft, Part 1, X-624-66-342, Goddard Space Flight Center, May 1966